NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	**Mathematics-III**	Subject Code	**MA20311CL**
Semester	B. Tech. – 3rd Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
4	1	0	5

Details of Course:

Unit –I Fourier Series
Euler's Formula, Functions having points of discontinuity, Change of interval, even & Odd functions, Half range series, Harmonic analysis.

Unit– II Laplace Transform
Definition, Transform of elementary functions, Properties of Laplace transform, of derivatives & integrals, Multiplication by tn, Division by t, Evaluation of integrals, Inverse Laplace function, Convolution theorem, Unit step functions, Unit impulse function, periodic function. Application to solution of ordinary differential equations.

Unit – III Partial Differential Equation
Formation, Solution by direct integration method, Linear equation of first order, Homogeneous linear equation with constant coefficients, Non-homogeneous linear equations, Method of separation of variables.

Unit – IV Complex Variable
Derivative, Cauchy-Riemann equations, Analytic functions, Harmonic functions, Flow problems, Complex integration, Cauchy theorem, Cauchy integral formula, Taylor & Laurent series, Singularity, Residue, Evaluation of real definite integrals.

Unit – V Statistics
Random variables, Discrete & continuous probability distributions, expectation, Mean & Standard Deviation, Moments & moment generating function, Distributions- Binomial, Poisson and Normal distributions.

Text Book:

1. Advanced Engg. Mathematics by Dr. B.S. Grewal- Khanna Publishers.
2. Advanced Engg. Mathematics by Erwin Kreyszib- Jhon Wiley & Sons.

References Books:-

1. Advanced Engg. Mathematics by R.K. Jain and S.R.K. Iyeng ar- Narosa Publishing House.
2. Applied Mathematics by P.N. Wartikar & J.N. Wartikar. Vol- II- Pune Vidyarthi Griha Prakashan, Pune.
3. Applied Mathematics for Engineers & Physicists by Louis A. Pipes- TMH.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR

CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	**Strength of Materials**	Subject Code	**ME20312CL**
Semester	B. Tech. – 3rd Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	0	4

Details of Course:

Unit –I
Stress (Axial Load): Normal stress, Shear stress, Factor of safety, plane stress, stress components associated with arbitrary oriented faces in plane stress.
Stress-Strain Relation: Hook's Law, Poission's ratio, strain components, strain components associated with arbitrary sets of axes, Tensile test, elastic stress-strain relation.

Unit– II
Torsion: Basic assumptions, Torsion formula, Hollow and Stepped circular shafts, Angular Deflection.
Flexural Loading: Theory of pure bending, Flexural formula, Shear force and Bending moments diagram for different types of loading and support conditions on beams. Transverse shear stress distribution in circular hollow circular, I-box and T, angle sections.

Unit – III
Deflection of Beams: Strain curvature and moment curvature relation, Solution of beam deflection problems by Direct integration method, Area moment method, super position.

Unit – IV
Principle Stresses and Strains: Normal and Shear stress, concept of equivalent bending & equivalent twisting moment, Mohr's circle of stress and strain, Strain Rosette's.

Unit – V
A) Columns: Euler's formula for different end conditions, Concepts of equivalent length, Eccentric loading, Ranking formula.
B) Pressure Vessels: Thin Pressure vessel Circumferential and longitudinal stresses in cylindrical shell, spherical shell under internal pressure. Introduction to thick pressure vessel.

Suggested Text Books & References:

1. Ramamurtham, S., "Strength of Materials", Dhanpat Rai & Sons, 1991.
2. Popov, E.P., "Mechanics of Materials", Printice Hall Inc. 1984.
3. Andrew, P. and Singer, F.L. "Strength of Materials", Happer & Row Publishers, New York, 1987.

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CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	**Computer Programming, in C++**	Subject Code	CL20313CL
Semester	B. Tech. – 3rd Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	0	4

Details of Course:

Unit-I

Characters used in c++, Data types, Flow chart, Arithmetic operations and expressions, Relational and logical operators, Hierarchy of operations, Standard library functions, Header files.

Unit-II

If -else statement, For loop, While loop, Break statement, Concept of array, Multi dimensional array, Inline function, Function , Pass by value, Pass by reference, Scope of integer and variables.

Unit-III

Pointer, Structure, Procedure and object oriented language, Class, Object, Inheritance, Type of inheritance

Unit-IV

Polymorphism, Run time polymorphism, Compile time polymorphism, Operator overloading, File handling.

Unit-V

Solution of chemical engineering problems related to mass, momentum, energy transfer: Newton- Raphoson method, Eulers method, Runga_kutta method, Simpson's rule. Gauss elimination method.

Name of Text Books:
1. John R. Hubberd, Programming with C++, Schaum's outline, Tata McGraw- Hill Publishing Co. Ltd., New Delhi.
2. Robert Lafore, Object Oriented Programming in C++, Sams Publication.
3. Grewal B. S., Numerical Methods in Engineering and Science, Khanna Publication, New Delhi.

Name of reference Books:
1. Venugopal K R, Rajkumar, Ravishankar, T., Mastering C++, Tata McGraw Hill. Publishing Co. Ltd., New Delhi.
2. Balagurusamy E, Object Oriented Programming with C++, Tata McGraw Hill, Publishing Co. Ltd., New Delhi.
3. Ravichandran, Programming with C++, Tata McGraw-hill Education Private Ltd., New Delhi.
4. Numerical Recipes in C++

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CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Inorganic Process Technology	Subject Code	CL20314CL
Semester	B. Tech. – 3rd Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works 3	Tutorial Periods/Week 1	Practical Periods/Week 0	Credits 4

Details of Course:

Unit – I
Unit operation and Unit process concepts, Soda Ash, Common Salt, Salt Cake and Glauber's Salt, Chlorine and Caustic Soda.

Unit – II
Sulfur and Sulfuric Acid Industries, Industrial Gases-Acetylene, Oxygen and Nitrogen, Carbon Dioxide, Hydrogen, Bromine.

Unit – III
Nitrogen Industries-Ammonia, Nitric Acid, Ammonium Nitrate, Phosphorous, Phosphoric Acid, Calcium Phosphates, Ammonium Phosphates, Urea.

Unit – IV
Hydrochloric Acid, Glass Industries, Sodium silicates, Ceramic Industries, Alumina, Aluminum, Magnesium.

Unit – V
Explosives-Types and Characteristics; Nitroglycerin and Dynamite, Nitrocellulose, Hydrazine, Military Explosives, Portland Cements, Lime.

Name of Text Books:

1. M. Gopala Rao and Marshall Sittig: Dryden's Outlines of Chemical Technology, III Edition; Affliated East-West Press Pvt Ltd, New Delhi.
2. George T. Austin : Shreve's Chemical Process Industries, McGraw Hill Book Company.

Name of Reference Books:

1. S.D. Shukla and G.N. Pandey, Text Book of Chemical Technology Vol 1, 1977.

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CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Industrial Process Calculation	Subject Code	CL20315CL
Semester	B. Tech. – 3rd Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	0	4

Details of Course:

Unit – I
Unit and its conversion, Stoichiometric & Composition relations PVT behaviors, Gas laws, Partial pressure and pure component volume methods. Concepts of degree of freedom.

Unit – II
Vapor-liquid equilibrium and concept of Humidity and saturation: Molal Humidity, Cox Chart. Analysis of processes involving condensation, crystallization & vaporization, psychometric chart, Crystallization.

Unit – III
Material Balance – Selection of a basis, conservations of mass/atom, material balance for systems with & without chemical reactions, analysis of systems with by pass, recycle & purge operations.

Unit – IV
Energy Balance calculations:
Calculation of heat of change of phase, heat of reactions, Dissolution & mixing, combustion. Energy balance with and without chemical reaction. Combustion calculations.

Unit – V
Effect of pressure & temperature on heat of reaction. Determination of temperature for adiabatic & non adiabatic reactions. Combined steady state material & energy balances for Units with multiple sub-systems.

Name of Text Books:

1. Bhatt and Vora, 'Stoichiometry', McGraw Hill Publications.
2. Hougen and Watson, "Chemical Process Principles Part – I Material and Energy Balance 2nd Edition.
3. Narayanan K.V. and Lakshmikutty B. "Stoichiometry & process calculations, Prentice hall of India.

Name of Reference Books:

1. Himmelblaue, Basic Principles and Calculations in Chemical Engineering, Pearson Education Pvt. Ltd.
2. Ghoshal, sanyal, Dutta, Introduction to Chemical Engineering.

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CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Material Technology	Subject Code	CL20316CL
Semester	B. Tech. – 3rd Semester	Board of Studies	Chemical Engg.
Maximum Marks	70	Minimum marks	25
Lecture period works	Tutorial Periods/Week	Practical Periods/Week	Credits
3	1	0	4

Details of Course:

Unit – I
Properties and behavior of materials useful in structure, machines and equipments, atomic arrangements and imperfections elasticity, micro elasticity and phase transformation. Theories of corrosion and corrosion and method of corrosion control.

Unit – II
Theory of alloying, constitutional diagrams, their construction and applications. Cast iron as material of construction with reference to its application in chemical Engineering, selection of material, general criterion of selection of material of construction in process industries.

Unit – III
Materials of construction and their technology with reference to application in chemical industry mild steel, high carbon steel, stainless steel, high silicon steel, molybdenum and tungsten steel, heat treatment of plane steel.

Unit – IV
Nonferrous metals – copper, aluminum, lead, chromium, tin, brass, bronze and monel.

Unit – V
Non-metals – Glass, Enamels, graphite, wood, plastics, rubber, ebonite lining materials, composite materials: fiber reinforced plastic composite material, concrete, asphalt and asphalt mixture, ceramic mixture and silicates, structure and properties, polymeric material.

Name of Text Books:

1. Russel E*Gackenbach, Materials selection for process plants.
2. Frank Ramford, Chemical Engineering materials.
3. Lee Z.Z., Materials of construction for Chemical Process Industries.

Name of Reference Books:

1. Agrawal B.K., Introduction to Engineering Materials.
2. Khurmi R.S., Materials Science.
3. Gupta K.M., Material Science & Engineering.

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
CHEMICAL ENGINEERING DEPARTMENT

Name of Subject	Inorganic Process Lab	Subject Code	CL20322CL
Semester	B. Tech. – 3rd Semester	Board of Studies	Chemical Engg.
Maximum Marks	20	Minimum marks	10
		Practical Periods/Week	Credits
		3	2

Experiments to be performed (minimum 10 experiments)
1. Determination of percentage % purity of H_2SO_4 of given acid sample
2. Determination of percentage % composition of NaOH and Na_2CO_3 sample
3. Determination of percentage silica present in the given Cement sample
4. Determination of the moisture present in the cement sample
5. Determination of the combustion loss in the cement sample
6. Determination percentage %Cu present in the given Copper Sulphate sample
7. Determination of the hardness (Total & permanent)of the water sample
8. Determination of percentage of lime present in the cement sample
9. Determination of % Ca in given Dolomite sample
10. Determination of % Mn in given Pyrolusite sample.
11. Determination of % Ca in given Lime stone sample.
12. Determination of % silica in given Ash sample.
13. Determination of N in given fertilizer sample
14. Determination of P in given fertilizer sample
15. Determination of K in given fertilizer sample
16. To prepare Chrome Red in lab.
17. Estimate the percentage of available Cl_2 in sample of bleaching powder by iodometry.

List of Equipments/Machines Required
(i) Weighing Balance
(ii) Muffle Furnace
(iii) Water Bath
(iv) Hot Air Oven
(v) Heating Mental
(vi) Silica Crucible

Recommended Books:
1. Outlilnes of Chemical Engineering – Dryden
2. Experimental Chemistry – S.S. Dara

NATIONAL INSTITUTE OF TECHNOLOGY, RAIPUR
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Name of Subject	Computer Lab	Subject Code	CL20323CL
Semester	B. Tech. – 3rd Semester	Board of Studies	Chemical Engg.
Maximum Marks	20	Minimum marks	10
		Practical Periods/Week	Credits
		3	2

List of programs:
1. Largest number among three numbers
2. To convert score into equivalent grade
3. To sum n numbers using while loop
4. To find sum of marks of six subject and its average for ten students using nested for loop
5. Program using while-break statement
6. Program using break and continue statement
7. Program using goto statement
8. Program using switch-case statement
9. Program to use mathematical function
10. User defined function and main function
11. To find maximum between two number using user defined function
12. To find maximum between two number using user defined function and do while loop
13. To find maximum between three numbers using functions
14. Program using call by value method
15. Program using call by reference method
16. Passing an array to a function and returning the sum
17. Program for more than one control variables
18. To initialize the array and print the value
19. Passing the value in array
20. Find the max value in given array
21. To change base of any no
22. Program for bubble sorting
23. Program for local variable and global variable
24. Program for structure
25. Program for class
26. Program for inheritance
27. Program for polymorphism
28. Program for file handling
29. Solution of differential equations